

What Is Claimed Is:

1 1. A method of making a stackable microcircuit layer comprising
2 the steps of:

3 providing a plastic encapsulated microcircuit (PEM) that includes

4 (a) a microcircuit having an active surface containing

5 integrated circuitry and a bond pad, and

6 (b) an encapsulant in contact with the microcircuit; and

7 modifying the PEM to produce a modified PEM having a modified

8 surface on which modified surface is exposed a conductive

9 member that is electrically connected to the bond pad.

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1 2. The method of Claim 1 further comprising the step of forming an
2 electrical lead on the modified surface of the modified PEM that leads from the
3 conductive member to an edge of the modified PEM

1 3. The method of Claim 1 wherein the microcircuit is a pre-tested
2 microcircuit.

1 4. The method of Claim 1 wherein the microcircuit is a burned-in
2 microcircuit.

5. The method of Claim 2 wherein the modifying step is accomplished through grinding.

✓ 6. The method of Claim 2 comprising the further step of covering the electrical lead with an insulating layer.

7. The method of Claim 1 comprising the further step of reducing the thickness of the modified PEM by thinning a backside of the modified PEM that is opposite to the electrical lead.

8. The method of Claim 7 wherein the step of reducing the thickness of the modified PEM by thinning a back side of the modified PEM is accomplished through grinding.

9. The method of Claim 1 comprising the further step of reducing the area of the modified PEM.

10. The method of Claim 9 wherein the further step reducing the area of the modified PEM is accomplished by sawing the modified PEM along one or more edges.

11. The method of Claim 1 wherein the conductive member that electrically connects to the bond pad is part of a wire bond.

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1 12. The method of Claim 11 wherein the conductive member is a
2 gold ball bond.

1 13. The method of Claim 11 wherein the conductive member is a
2 wire.

1 14. The method of Claim 11 wherein the conductive member is a
2 wedge bond.

1 15. The method of Claim 11 wherein the conductive member is a
2 lead frame.

1 16. The method of Claim 1 wherein the conductive member that
2 electrically connects to the bond pad is a conductive trace on a flexible
3 substrate.

1 17. The method of Claim 16 wherein the conductive trace is a
2 flexible lead beam and the flexible substrate is a polyimide film.

1 18. The method of Claim 1 wherein the PEM's encapsulant is a
2 plastic body that at least partially encapsulates the microcircuit.

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1 19. The method of Claim 18 wherein the conductive member that
2 is electrically connected to the bond pad is encapsulated in the plastic body of
3 the PEM and wherein the modifying step comprises thinning a first side of the
4 PEM to expose the conductive member.

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1 20. The method of Claim 19 wherein the PEM comprises a thin
2 small outline package (TSOP) containing a gold ball bond, a lead frame, and a
3 wire that are collectively encapsulated in the plastic body of the PEM, wherein
4 the gold ball bond is formed on the bond pad, wherein the wire connects the gold
5 ball bond to the lead frame, and wherein the gold ball bond is the conductive
6 member exposed on the modified surface of the modified PEM through thinning.

1 21. The method of Claim 20 wherein the thinning removes the lead
2 frame and the wire along with a portion of the plastic body.

1 22. The method of Claim 18 wherein the PEM comprises a uBGA
2 package that includes a polyimide film and a flexible lead beam that are
3 collectively encapsulated in the plastic body, wherein one end of the flexible lead
4 beam is connected to the bond pad, and wherein a solder ball is deposited onto
5 an exterior side of the polyimide film in contact with an opposite second end of
6 the flexible lead beam.

1 23. The method of Claim 22 wherein the modifying step comprises
2 removing at least a portion of the solder ball.

1 24. The method of Claim 23 wherein the removing of at least a
2 portion of the solder ball is accomplished by heating the solder ball to form
3 molten solder and wicking away the molten solder.

1 25. The method of Claim 24 wherein the he removing of at least a
2 portion of the solder ball is accomplished by shearing.

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1 26. A method of making a stackable microcircuit layer comprising
 2 the steps of:
 3 providing a plastic encapsulated microcircuit (PEM) that includes:
 4 (a) a microcircuit having a bond pad,
 5 (b) a conductive lead assembly connected to the bond pad,
 6 and
 7 (c) a plastic body encapsulating the microcircuit, the bond
 8 pad, and at least part of the conductive lead
 9 assembly; and
 10 grinding a top surface of the PEM to remove a top portion of the
 11 plastic body along with at least part of the conductive lead
 12 assembly to leave a planar section that contains the
 13 microcircuit and the bond pad.

1 27. The method of Claim 26 further comprising the step of forming
 2 an electrical lead on top of the planar section which leads from the bond pad of
 3 the microcircuit to at least one edge of the planar section.

1 28. The method of Claim 26 wherein the grinding step also leaves
 2 a vestigial part of the conductive lead assembly in the planar section.

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1 29. The method of Claim 26 wherein the vestigial part of the
2 conductive lead assembly is a part of a wire bond.

1 30. A method of making a stackable microcircuit layer comprising
2 the steps of:

3 providing a plastic encapsulated microcircuit (PEM) that includes

4 (a) a microcircuit having an active surface containing
5 integrated circuitry and a bond pad,

6 (b) a wire bond connected to the bond pad, a lead frame,
7 and a wire that connects the wire bond to the lead
8 frame, and

9 (d) a plastic body that encapsulates the known-good
10 microcircuit, the wire bond, the wire, and at least a
11 portion of the lead frame;

12 grinding a surface of the PEM to remove the lead frame and the

13 wire and form a modified PEM that contains the microcircuit,

14 the bond pad, and the wire bond, the modified PEM having a

15 modified surface on which modified surface is exposed the

16 wire bond that is connected to the bond pad; and

17 forming an electrical lead on the modified surface that leads from

18 the wire bond to an edge of the modified PEM.

1 31. The method of Claim 30 wherein the PEM has a package form
2 factor known as a thin small outline package (TSOP).

1 32. The method of Claim 30 comprising the further step of
2 covering the electrical lead with an insulating layer.

1 33. The method of Claim 30 comprising the further step of
2 reducing the thickness of the modified PEM by thinning a backside of the
3 modified PEM that is opposite to the electrical lead.

1 34. The method of Claim 30 comprising the further step of
2 reducing the area of the modified PEM.

1 35. The method of Claim 34 wherein the further step reducing the
2 area of the modified PEM is accomplished by sawing the modified PEM along
3 one or more edges.

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- 1 36. A stackable microcircuit layer comprising:
 - 2 (1) a modified section of a plastic encapsulated microcircuit (PEM)
 - 3 that originally contained (a) a known-good microcircuit
 - 4 having a bond pad, (b) a conductive lead assembly
 - 5 connected to the bond pad, and (c) a plastic body
 - 6 encapsulating the known-good microcircuit, the bond pad,
 - 7 and the conductive lead assembly,
 - 8 the modified section formed by removing a portion of the
 - 9 conductive lead assembly from the PEM;
 - 10 the modified section having a modified surface,
 - 11 the modified section containing the known-good microcircuit, the
 - 12 bond pad, and a remaining portion of the conductive lead
 - 13 assembly with an end thereof exposed on the modified
 - 14 surface; and
 - 15 (2) a reroute lead on the modified surface of the modified section to
 - 16 connect the exposed portion of the remaining portion of
 - 17 conductive lead assembly with an edge of the modified
 - 18 section.

2 37. The stackable microcircuit layer of Claim 36 wherein the
3 commercially packaged microcircuit assembly has a package form factor known
4 as a thin small outline package (TSOP).

1 38. The stackable microcircuit layer of Claim 37 wherein the
2 modified section is a planar section containing the known-good microcircuit, the
3 bond pad, the remaining portion of the conductive lead assembly, and a
4 reduced-height portion of the plastic body.

1 39. The stackable microcircuit layer of Claim 38 wherein the
2 conductive lead assembly originally comprises a wire bond, a lead frame, and a
3 wire that are collectively encapsulated in the plastic body of the PEM, wherein
4 the wire bond is formed on the bond pad, and wherein the wire connects the wire
5 bond to the lead frame.

1 40. The stackable microcircuit layer of Claim 39 wherein the
2 remaining portion of the conductive lead assembly that is exposed on the
3 modified surface is the wire bond.

1 41. The stackable microcircuit layer of Claim 40 wherein the wire
2 bond is exposed on the modified surface by grinding away a portion of the plastic
3 body along with the lead frame, the wire, and a portion of the wire bond.

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1 42. The stackable microcircuit layer of Claim 36 wherein the
2 commercially packaged microcircuit assembly has a package form factor known
3 as a micro-Ball Grid Array (uBGA) package.

1 43. The stackable microcircuit layer of Claim 42 wherein the
2 modified section contains the known-good microcircuit, the bond pad, the
3 remaining portion of the conductive lead assembly, and the plastic body.

1 44. The stackable microcircuit layer of Claim 43 wherein the
2 conductive lead assembly originally comprises a conductive trace, a flexible
3 substrate that supports the conductive trace, and a solder ball, a first end of the
4 conductive trace connected to the bond pad and a second end of the conductive
5 trace connected to the solder ball.

1 45. The stackable microcircuit layer of Claim 44 wherein the
2 remaining portion of the conductive lead assembly that is exposed on the
3 modified surface is the second end of the conductive trace.